Method and apparatus for hull integrated seawater reverse osmosis system

FIELD OF THE INVENTION

The present invention relates to a method and apparatus for having a integrated fluid media filtration and membrane unit within the hull of a sea-bound vessel. The vessel's propulsion will drive the flow of seawater into the media filtration and membrane unit. Multiple stages of the passing of seawater via the membrane and/or a series of progressive membranes can be implemented to reduce the level of sodium chloride present in seawater to desirable specifications.

There are a variety of methods and processes that are currently deployed to make use of seawater as a desalination source, thereby creating new avenues whereby drinking water can be processed and utilized.

One such method is reverse osmosis of seawater, whereby seawater is removed of sodium chloride, and with further processing, including the irradiation of ultraviolet rays to destroy any bacteria or micro-organisms present to yield highly purified water that is suitable for applications that go beyond drinking water.

It is commonly known that purified water (also called ultra pure water) increases the overall efficiency of turbines in a steam-powered powerplant, and due to the absence of a significant quantity of minerals (including sodium chloride), extends the operating life-span of the individual turbine blades.

There are already many geographical locations around the world today that are facing chronic shortages of drinkable water.

Yet, the design, construction and operation of reverse osmosis plants are still expensive and therefore are generally out of the reach of many (in terms of cost of consumption versus the cost of conventional drinking water sources).

In the Republic of China for example, many regions near industrial zones are faced with the prospect of severe water shortages due to poor water distribution networks, in-balances in the consumption of water by water intensive industries such as semiconductor fabrication etc.

The quality of water distribution networks cannot be under-estimated, in many cases, the amount of water available to a population of consumers and industrial users are greatly impacted by the efficiency of such networks.

Leaky pipes, corroded gaskets and faulty pipe pumps reduce the absolute water supply that can be distributed at any one time.

However, the repair and maintenance of these networks is not easy nor affordable.

From an economic stand-point, the decision to distribute water via water pipelines or having vessels storing the water into tanks (and having them transported to the location for consumption) may be determined by factors such as cost, operating capability, consumption range etc.

The use of oil pipelines and oil tankers is one such example.

The price of drinkable water is indeed on par, if not more costly than crude oil in areas of the Middle East, making it economical to build desalination plants to make use of seawater for conversion into drinking water.

There is already a growing trend in many places around the world whereby the price point of water may match the cost of crude oil imports (comparison by absolute volume).

It is therefore possible for sea-going vessels to transport purified water from an oil importing region to an oil exporting region, and return oil, in exchange for water, to the oil importing region.

It is also foreseeable that sea-going vessels may make use of the seawater to convert into purified water for storage on-board these vessels, for export to far flung regions, while making the cost of such water within reach of many (this is due to the multiple consumption markets that is within reach of the sea-going vessel capable of desalinating sea-water into fresh water).
The ability for water desalination systems to be mobile reduces the overall cost of purified water, by maximizing the reach of potential consumers while at the same time, reducing the need for capital expenditure in individual regions where desalinated water is desirable.

SUMMARY OF THE INVENTION

It is object of the present invention to provide for a method and apparatus for having a integrated fluid media filtration and membrane unit within the hull of a sea-bound vessel. The vessel's propulsion will drive the flow of seawater into the media filtration and membrane unit. Multiple stages of the passing of seawater via the membrane and/or a series of progressive membranes can be implemented to reduce the level of sodium chloride present in seawater to desirable specifications.

The present invention consists of a sea-going vessel, or any device capable of propulsion or floatation in areas where seawater or naturally occurring water is available.

The said vessel will be constructed with suitable valves or openings capable of intake of seawater during the vessel's propulsion.

In addition, the said vessel constructed with the said valves will also be capable of intake of seawater in a stationary position, having the said valve to be located within the level of seawater surrounding the said vessel.

The main function of the valves incorporated into the sea vessel hull is primarily to accept seawater via pipes connected to the said valves for routing of the said seawater into a suitable seawater storage tank.

The valves will be operated by means of a suitable prime mover such as an electric motor, AC alternator, or powerplant to ensure that the valve can open or close the valve opening to control the rate of seawater intake.

The construction of the valve may be constructed to be flush with the surface of the sea vessel hull, and may, optionally, include hardware that can prevent solid objects or other form of large particles to be filtered away from the valve opening.

Alternatively, the valve may be constructed to be protruding from either the hull surface, or surface area perpendicular to and/or along the length of the sea vessel.

The present invention will also include the construction of filters within pipes connected to the said valves to remove any media (or particles) that may accompany the intake of seawater via the valve.

The said pipes may also be fitted with membranes that can suitably remove a specific amount of sodium chloride and/or other impurities from the seawater being brought into via the said valves incorporated into the hull of the sea vessel.

BRIEF DESCRIPTION OF THE DRAWINGS

Illustrative embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 illustrates a perspective diagram of a sea vessel with a valve fitted onto the surface of its hull.

Figure 2 illustrates a perspective diagram of a sea vessel with a valve combined with additional filters and at least 1 membrane to filter seawater incoming via the said valve to yield seawater with a reduced amount of impurities, such as sodium chloride.

Figure 3 illustrates filtered seawater incoming from the valve fitted onto the hull of the sea vessel, being routed onto a assembly of devices capable of performing reverse osmosis to further purify the filtered seawater.

Figure 4 illustrates a side view diagram of the major components and devices that are required for the processing and purification of seawater collected from valves constructed onto the hull surface of a sea vessel.

Figure 5 illustrates the forward direction induced from the mechanical work imposed by a suitable powerplant unit installed within the sea vessel, enabling seawater to be fed into the valves constructed to accept the intake of seawater.

Figure 6 illustrates how a suitable pump can be powered by auxiliary batteries charged by alternators connected to the sea vessel powerplant, enabling the said pump to continue feeding seawater into the pipes connected to the valves fitted onto the surface of the sea vessel hull, in the event whereby the sea vessel is stationary.

Figure 7 illustrates the construction of a valve assembly incorporated with a suitable reverse osmosis membrane for processing of seawater (stage 1) in a typical reverse osmosis process.

Figure 8 illustrates the construction of a valve assembly capable of routing seawater being treated by at least 1 reverse osmosis membrane, to a second valve and membrane assembly to further pass the said treated water to a second pass of another similar reverse osmosis membrane.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Figure 1 illustrates a perspective diagram of a sea vessel with a valve fitted onto the surface of its hull.

The vessel's hull 20 is partially submerged to the seawater level 10. Beneath the seawater level 10, a pre-treatment filter valve 30 is fitted to the vessel's hull 20.

As the vessel moves along the water, jets of seawater flows into the said valve and directed into the pass reverse osmosis unit 40 installed in the vessel's body.

Figure 2 illustrates a perspective diagram of a sea vessel with a valve combined with additional filters and at least 1 membrane to filter seawater incoming via the said valve to yield seawater with a reduced amount of impurities, such as sodium chloride.

An improved embodiment is to install additional filters after the seawater collection valve R1. The seawater is passed into a membrane unit R2 and to further filter the seawater a second stage of processing R3 is added to further desalinate the seawater.

After the seawater water is processed, the purified water is stored into storage tanks R4 for

storage and eventual consumption.

Figure 3 illustrates filtered seawater incoming from the valve fitted onto the hull of the sea vessel, being routed onto a assembly of devices capable of performing reverse osmosis to further purify the filtered seawater

In yet another improved embodiment, the untreated seawater is channelled through a pre-treatment filter valve G1, which segregates the unwanted solid matters from the seawater. The said solid matters may be organic matter like fish or inorganic matters like man-made rubbish floating in the seawater. The filtration also prevents the clogging to occur in the membrane unit G3.

Figure 4 illustrates a side view diagram of the major components and devices that are required for the processing and purification of seawater collected from valves constructed onto the hull surface of a sea vessel

The seawater is first collected by the valve A-1 located at the front hull of the vessel. The system pump C-3 is required to pump the seawater into respective chambers for treatment. Treatment of seawater takes place at the membrane to 03 and ultra-violet irradiation unit B-2.

The vessel and the treatment plant is powered by a power plant located in the vessel with auxiliary batteries to serve as backup D-4 as well as the kick-starting of the treatment process.

After treatment of seawater, the treated water is pumped into storage tanks E-5.

Figure 5 illustrates the forward direction induced from the mechanical work imposed by a suitable power plant unit installed within the sea vessel, enabling seawater to be fed into the valves constructed to accept the intake of seawater
The seawater flows into the valve as shown by the arrow 3000 whereby the vessel is partially submerged in the seawater. The vessel power is powered by the power plant 1000 in order to propel itself across the sea.

Figure 6 illustrates how a suitable pump can be powered by auxiliary batteries charged by alternators connected to the sea vessel powerplant, enabling the said pump to continue feeding seawater into the pipes connected to the valves fitted onto the surface of the sea vessel hull, in the event whereby the sea vessel is stationary

When the vessel is stationary, the auxiliary batteries s4 will kick-start the pump s5 and pumped the seawater into the valve to carry on the treatment process.

Figure 7 illustrates the construction of a valve assembly incorporated with a suitable reverse osmosis membrane for processing of seawater (stage 1) in a typical reverse osmosis process.

Figure 8 illustrates the construction of a valve assembly capable of routing seawater being treated by at least 1 reverse osmosis membrane, to a second valve and membrane assembly to further pass the said treated water to a second pass of another similar reverse osmosis membrane.

Modifications within the spirit and scope of the invention may readily be effected by persons skilled in the art. It is to be understood, therefore, that this invention is not limited to the particular embodiments described by way of example hereinabove.